

WARM-UP

Give coordinates for the point that is:

1. a units to the right of (x, y) 2. b units to the left of (x, y)

$$(x + a, y)$$

$$(x - b, y)$$

3. c units up from (x, y)

4. d units down from (x, y)

$$(x, y + c)$$

$$(x, y - d)$$

5. e units up from and f units to the left of (x, y)

$$(x - f, y + e)$$

SECTION 3-2

THE GRAPH-TRANSLATION THEOREM

Translation Image: Where the graph is *after* it has been translated

Preimage: The original graph, often one of the parent functions

Translation: A transformation that maps each point (x, y) onto $(x + h, y + k)$

Basically, it moves the graph to a different spot, using a horizontal magnitude (h) and a **vertical** magnitude (k)

EXAMPLE 1

Under a translation, the image of $(0, 0)$ is $(7, 8)$.

- a. Find a rule for this translation.

$$(x + 7, y + 8)$$

- b. Find the image of $(6, -10)$ under this translation.

$$(x + 7, y + 8) \longrightarrow (6 + 7, -10 + 8) \longrightarrow (13, -2)$$

GRAPH-TRANSLATION THEOREM

In a relation using two variables (in this case x and y), we can find the translation by doing one of the following:

1. Replace x with $x - h$ and y with $y - k$ in the equation

OR

2. Apply the translation $(x, y) \rightarrow (x + h, y + k)$ to the graph of the original

EXAMPLE 2

- a. Compare the graphs of $y = x^2$ and $y + 5 = (x + 4.2)^2$

The parabola moved 4.2 units to the left and 5 units down when compared to the parent function

$$\text{Rule: } (x, y) \rightarrow (x - 4.2, y - 5)$$

- b. Find the coordinates of a point on each graph so that the points correspond under the translation.

$$\text{ex. } (3, 6) \rightarrow (3 - 4.2, 6 - 5) \rightarrow (-1.2, 1)$$

EXAMPLE 3

If the graph of $y = x^2$ is translated 2 units up and 3 units to the left, what is an equation for the image?

$$y - 2 = (x + 3)^2$$

In standard form:

$$y = x^2 + 6x + 11$$

EXAMPLE 4

Describe the translation that exists between the graph of $y = x^2$ and the graph of $y = x^2 - 6x + 8$.

We need to rewrite the equation in vertex form. How do we do that?

COMPLETE THE SQUARE!

$$y = x^2 - 6x + 8$$

$$y - 8 + \underline{\quad} = x^2 - 6x + \underline{\quad}$$

$$y - 8 + \underline{9} = x^2 - 6x + \underline{9}$$

$$y + 1 = (x - 3)^2$$

$(x + 3, y - 1)$ or, right three, down 1

HOMEWORK

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